United States and/or Canada. Some critics might argue that it could have been obtained in Siberia or China, for example and brought to America for display. This would not be a serious problem for at least two reasons.

First, simply proving the creature's existence at any location is the biggest point that has been located by the sceptics, and that point would have been won. Second, the mass of reports of creatures closely matching this description in America is so great that few people would seriously dispute the claimed location in general, though the exact spot might be disputed. In addition, the actual circumstances of the acquisition would probably be too impressive to conceal, especially if it is the whole body, and the act of bringing it from a distant location would be equally difficult to conceal.

Producing the remains of a puma, claimed to have been shot in Virginia, would be summarily dismissed by most authorities. The sceptics would immediately say that it had most likely come from some other location where the existence of the puma is not questioned. The burden of proof would be on the collector to show where it was taken. Reports of the eastern puma are not nearly as impressive as those of the sasquatch – there would be little support from local accounts simply because it is not a new animal. The actual circumstances of acquiring such a small animal would not be easily demonstrable, especially if it is just the skull, and the act of bringing it in from a not-so-distant location could have been easily concealed.

In the United Kingdom we have two comparable examples of these same second and fourth categories. The Loch Ness Monster is a case of 'unexpected morphology'; the retrieval of a specimen would almost certainly demonstrate its existence, as well as show just what kind of a creature it is.

Whether such a specimen was actually from Loch Ness is less important than proving the reality of an animal of this type (whatever that might be). Also, the long history of sightings at that location would strongly support the claim of where it was taken. Finally, its presumably large size would make it difficult for anyone to argue that it was brought in from some distant source. Accordingly, it can be argued that efforts should be made to retrieve such a specimen by any and all possible means – perhaps harpooning by (hopefully) unemployed whalers.

The beast of Exmoor is a case of 'unexpected place'; the retrieval of a specimen would not demonstrate the existence of this feline species, simply because that was generally not an issue of disagreement. The history of sightings might support the claim of where it was taken, but not strongly; there are far better accounts of large black cats from elsewhere. Also, parts of black leopards, or melanistic pumas may be small enough to bring into the country without great difficulty. Finally, the possibility exists that such an animal had recently escaped from captivity. Accordingly, it can be argued that no effort should be made to kill or even capture a specimen of this type.

There are many other aspects to the problem of whether and how to collect cryptozoological specimens. Perhaps the readership's reaction to this article will determine if and what I might address in another article.

The author and the editor welcome comments on this article for inclusion in the letters page of a future issue.

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1995

CRYPTOCETOLOGY:

Introducing a new branch of Cryptozoology

(Part one of a seven part series in which Darren Naish explores the world of mystery whales)

How mysterious are whales? It depends on how much you know about them! The more you know, the greater the number of enigmatic whales you will learn about. This might be a bit of a strange idea to begin with - animal groups well established in the dogmas of zoology aren't immediate candidates for prominence in the annals of cryptozoology. Sea serpents and almas, (maybe batsquatches and mothmen) come to mind, yes, but whales?

On the 16th September 1994 I opened a book by travelling naturalist Sir Peter Scott [1]. There, on page 254, were his illustrations of a species of dolphin that he saw in the Magellan Straits in 1968. I didn't recognise them as being members of any known species and, after consulting the literature, had to consider the possibility that here was a 'new' species of dolphin, lying undiscovered in a book printed in 1983. This was an exciting concept that really got me enthused, and I began researching in earnest. The find was, as it turned out, somewhat of an ice-berg tip. Within a very short time available literature was revealing a veritable wealth of whale species which had been seen, sometimes even photographed, but were as yet unknown from specimens. Heuvelmans recognised eight species [2] on this basis, but more seemed to be present. The more I looked, the more I found, and what started as a project involving a single illustration in a single book metamorphosed into a number of interrelated topic areas, quite extensive amongst cetology (the study of whales) in their coverage.

Was this news? I think that it would depend on who you asked. Whales are marine, mysterious and elusive; for as long as cetology has been a science, the cetologists have been hinting at what I call 'habitat-induced elusiveness'. Whales are merely proving the bias there is against the discovery of marine forms, for, if you spend a greater proportion of your life beneath the surface of the waves, mankind has not yet gotten much of a chance to get to know you. Of course, not only is this proven by as-yet-undiscovered species, modern species that have remained unknown (or practically so), until very recently endorse it also. Case studies for this are well known and in some cases becoming more so; such as the coelacanth, megamouth, even certain whale species themselves [3]. Good old-fashioned elusive species proving more diversity amongst living forms than we'd anticipated, aren't, however, the entire story. These fascinating animals will be covered in article four, whereas Scott's mystery Dolphin will be covered in article two. This topic is large enough to be considered as a subject in its own right. I have coined the name CRYPTOCETOLOGY, merging the study of whales with the principles that we have learned (or 'have yet to learn') from cryptozoology. This first article is mainly a primer to familiarise you with names and ideas which will be introduced in successive articles. To begin with, therefore, a basic introduction to the diversity amongst whales, and the evolution which has lead to this diversity is in order. I hope that you find it as interesting as I do.

The Evolution of Whales and the cryptocetological aspects therein.

The great whales and their smaller cousins form a mammalian group that we call the Cetacia, or, in common parlance just Whales. Awe inspiring, beautiful, colourful and often damn weird, these amazing creatures have adapted themselves to a realm so different from our own that they function in ways that we are still struggling to understand. Whales are a diverse group of animals and, when we consider the extinct

species as well as the living ones become even more so.

The present opinion is that the Cetacea are monophyletic, which means that they all share the same single ancestor. (There have been dissentions [4] [5]). This single ancestor, one of the mesonychids [6]. (omnivorous wolf-like ungulates), was an amphibious, fish eating mammal that took to an aquatic lifestyle during the early Eocene, about 50 Million years ago. On acquiring characters that we now use to define 'whale' [7], these animals therefore became the first whales. They are called protocetids and, while very different from the fully aquatic whales that would be their eventual descendants, did enjoy success in the seas and estuaries of the world. A protocetid, as the recently discovered *Ambulocetus natans* [7], has shown, would have looked something like a long snouted sea-lion *(figure one)*. While protocetids were ancestral to later whales, they may well have been a more explicit cryptozoological link! (I will keep you in suspense until article three). (There are I have to say, other theories on the origin of whales, some of which directly challenge the evidence presented here. These will be discussed in a future article).

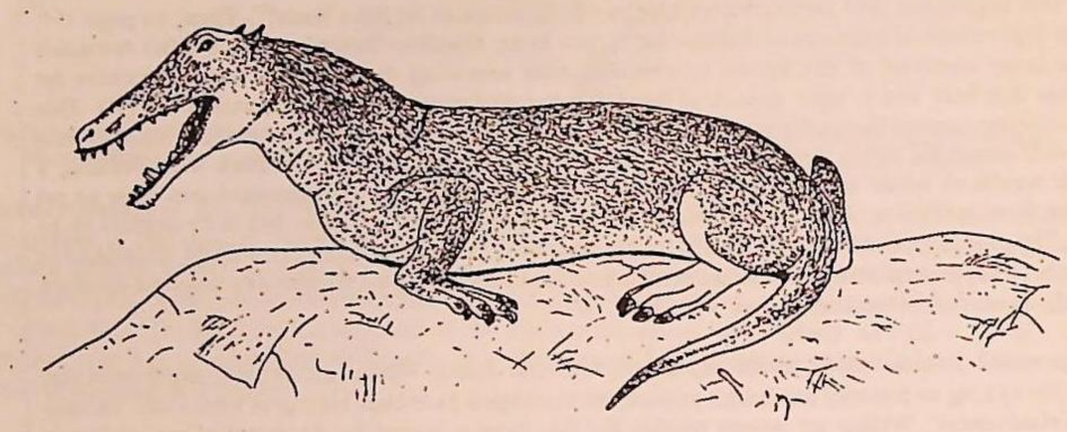

Fig. 1. *Ambulocetus natans*, a 49 million year old protocetid whale from the Upper Kuldana formation In Pakistan. Note the presence of fur and the abscence of tail flukes.

On becoming more specialised, and generally better adapted to a marine existance, *protocetids* became *basilosaurids*. These whales are best known for *Basiliosaurus*, a 20 metre-or-more long form from the late Eocene. It and its relatives, long known as *zeuglodonts* also turn out to have more than their fair share of cryptozoological importance and thus also get fuller discussion in article three. Both *protocetids* and *zeuglodonts* (and a few other poorly known Eocene families) are lumped together as *'archaeocetes'* - basically whales that lack the specialisations used to identify the two later whale groups whose respective histories begin in the Oligocene *(see fig 2)*.

The Rise of Modern Whales.

All post-archaeocete whales are separated into those with teeth - the *Odontoceti* - and those with baleen (whalebone) instead of teeth - *Mysticeti*. Both groups arose from within the *Archaeoceti*, independently, some have maintained [8], [9], [10], but there is now at least some molecular evidence suggesting that

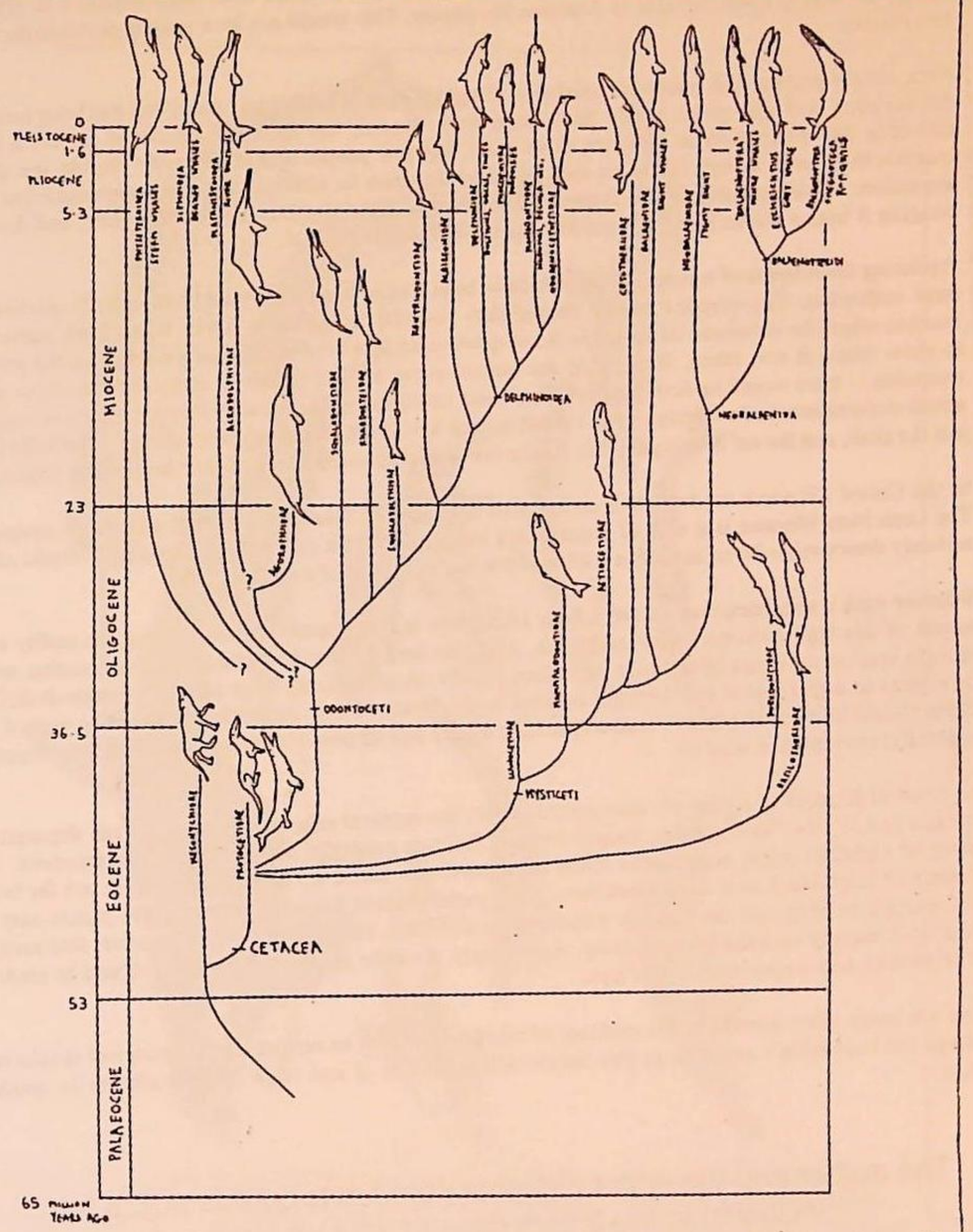

Figure 2. A phylogeny of cetaceans based on currently recognised ideas. Based mostly on Folkens and Barnes [12] with additional material from [13] and [14]. The Ilanocetids are too poorly known for a restoration, the two figures for the Protocetidae represent the morphological variation known in that family. No figures are to scale.

mysticetes share an ancestor with odontocetes. The first toothed whales, relatives of forms like Squalodon *(fig 3)*, appeared early in the Oligocene [11], about 37 million years ago as shown in fig 2, and by about 30 million years ago had given rise to four lineages. Those leading to sperm whales *(physeteroids)*, beaked whales *(ziphoids)*, river dolphins *(platanistoids)* and typical dolphins, *(delphinoids)*. During the Miocene (23-5.3 million years ago), the basic dolphin design, exemplified by the *delphinoids*, was successfully adapted to life in polar regions, rivers, and both deep water and shallow marine areas. Three families of the *Delphinoidea* survive today and, as illustrated in fig. 4 encompass the greatest variation amongst living whales.

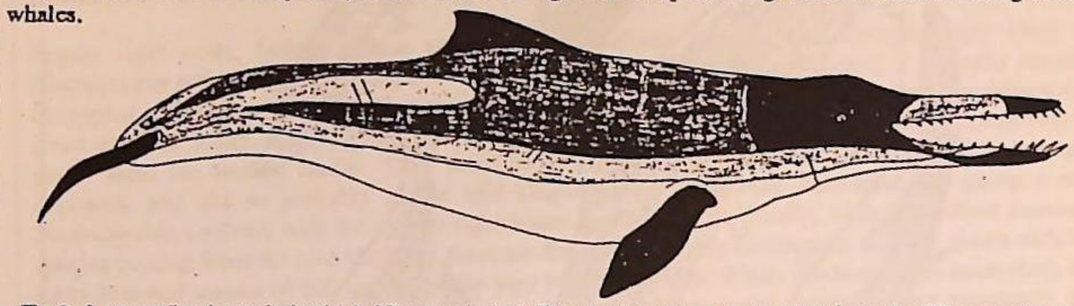

Fig 3. A generalised squalodontid *(c.f Prosqualodon)*. This family was most abundant from the Oligocene to early Miocene times, and were amongst the earliest and most primitive of *odontocete* whales. After Folkens [12].

Delphinoids range in size from the 36 kilo mass and 1.35 metre length of the smallest to the 8 tonnes and 9.75 metres of the biggest. Some, arguably the most exciting of all whales, are active and ferocious predators of other whales. At least one, the Orca *(Orcinus orca)*, is a co-operating pack hunter. Nearly all members of the delphinoid clan have a dorsal fin - one enigmatic species may even have two [15], and one, the fabled Narwhal *(Monodon monoceros)* of the high arctic, has a 'horn' (really an incisor tooth). A recently discovered relative of the narwhal from the Pliocene of Peru, (*Odobenocetops* [13], was a cetacean mimic of walruses. It even had tusks.

The evolution of a sophisticated sonar system has allowed whales, delphinoids among them to exploit environments where other senses, like sight, were not usable. A number of lineages seem to have independently invaded muddy rivers, and are today represented by eight species of river dwelling dolphin. Five of these species are the superficially similar, poorly sighted *platanistoids (see figs 2 and 4)*. For a long time they were thought to represent a single, specialised lineage, but it now seems that some, at least evolved independantly of the others. Their marine ancestors are known from early in the Miocene and possibly invaded river systems because they were a habitat largely unexploited by large, aquatic vertebrates at the time. Mainly due to this newer habitat, though their elusive behaviour certainly helps, the living examples of this group are very poorly known and continue to tantalise us with an abundance of mystery forms, some only just revealing themselves to the eyes of man. These will be dealt with in article five.

The Oligocene period seems to have been the time of greatest divergence amongst whales [11]. The other extant groups evolved at this time also. DNA evidence presented by Milinkovitch and colleagues in 1993 [17] suggested that mysticetes diverged from sperm whales about twelve millionyears ago, during the mid-late Miocene. However, a number of fossils, both of early mysticetes and of sperm whales are known from the early Oligocene (35 million years ago) [11] [18], casting doubt upon this hypothesis. A new and more thorough genetic analysis published in 1994 demonstrated that not only are mysticetes monophyletic, they are far removed from sperm whales who seem to have evolved from other odontocetes early on in odontocete history.[14] *(see fig 2)*. Though they have now been effectively challenged Milinkovitch and

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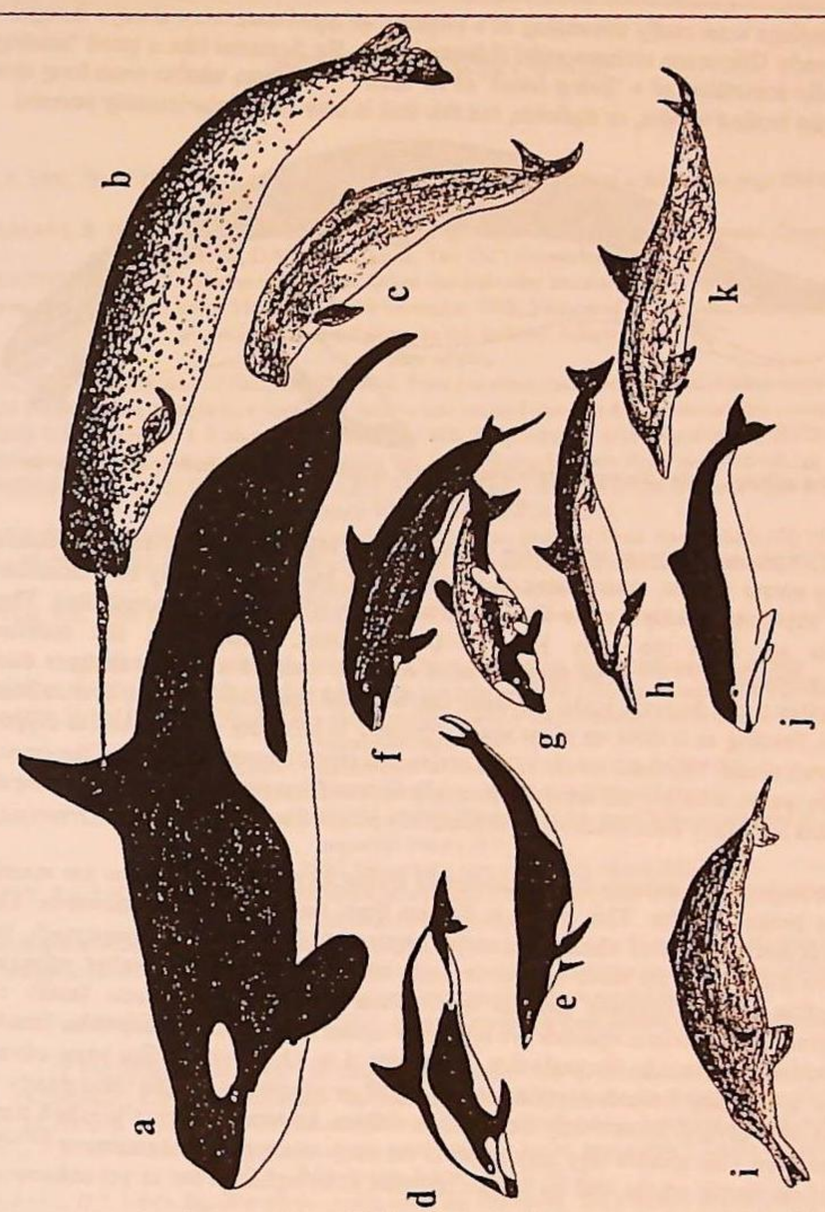

Figure 4. Some of the diversity amongst the delphinoid superfamily with one representative *platanistoid (river* dolphin). a) Orca, a *'globocephalid'*). b) Narwhal, representing one subfamily of the *Monodontidae*; c) Snubfin *(Orcaella brevirostris)*, probably a monodontid also; d) Hourglass Dolphin *(Lagenorhynchus cruciger)*; e) Northern Rightwhale Dolphin *(Lissodelphis borealis)*); f) Pygmy orca *(Feresa attenuata))*, another *'globocephalid'*; g) New Zealand Dolphin *(Cephalorhynchus hectori))*; h) Spinner *(Stenella longirostris)*; i) Ganges dolphin *(Platanista gangetica)*, a platanistid river dolphin; j) Spectacled Porpoise *(Australophocaena dioptrica)* of Phocoenidae; k) Roughtooth *(Steno bredanensis)*. Common names adapted from [16].

colleagues' DNA findings were really something of a surprise, as mysticetes were always thought to have been derived from early Oligocene archaeocetes. (*Mammalodon*, fig 5, seems like a good 'missing link', though it was actually something of a 'living fossil' of its time [19].). Sperm whales were long thought to have been allied to the beaked whales, or ziphoids, but this link is now fairly unanimously severed.

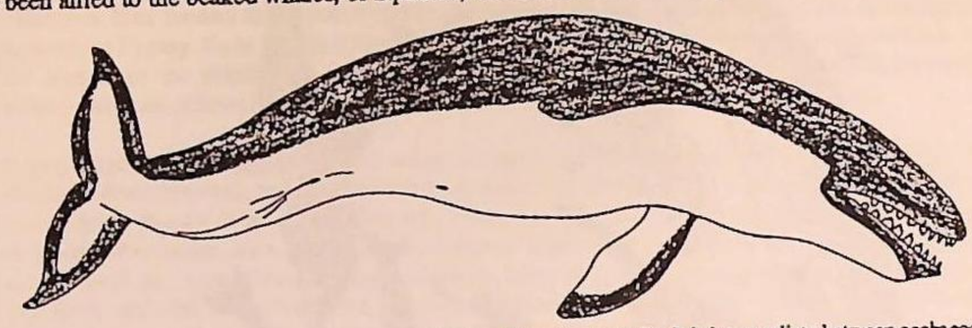

Figure 5. *Mammalodon colliveri*, a late Oligocene whale from Victoria, Australia. It is intermediate between archaeocetes and mysticetes[20].

The three (known!) species of sperm whale are probably best regarded as two separate families (21). *Kogiids*, the pygmy sperm whales, extend back as far as the late Miocene and may be descendants of the *physeterids*, today represented only by the Great Sperm Whale *(Physeter macrocephalus)*. The earliest known physeterids are from the early Miocene (contradicting, incidentally, the conclusions of Milinkovitch and colleagues) [14] [18]. The sperm whales acquired numerous unique features during their evolution and together these features make *Physeter* the weirdest mammal that has ever existed (in my opinion of course). Feeding as it does on giant squid, *Physeter* is probably more linked to cryptozoology than any other known whale. The final article in this series will cover *Physeter* and all of the associations it has with the cryptic world, whereas the article before will feature *Physeter's* pygmy cousins together with the other species that have only been discovered in relatively recent times.

To many cryptozoologists, the animals that immediately spring to mind when whales are mentioned are the *ziphoids* - the beaked whales. This group is known from the mid Miocene onwards. They share asymmetrical skulls and 21 pairs of chromosomes (as opposed to 22) with the *physeteroids*, but it now seems that the two groups are no more related to each other than they are to other *odontocetes*. An alternative suggestion is that ziphoids are the descendants of an early Miocene family called the *Squalodelphidae (see fig.2)*. Modern *ziphoids* are relatively conservative, mostly deepwater forms, (though they did evolve freshwater forms in the past) that range from 4 to 12.8 metres - like some other cetacean groupgs they have a tendancy towards toothlessness. The 19 or so species are the most poorly known of all large mammals with several known only from bones. Others, known only from beached corpses, also have yet to be seen alive. One species may play a part in the story of a reptilian sea monster [22] [23]. and still others form part of my fourth article, that on whales reported from sightings but as yet unknown from any specimens.

Diversification of the Mysticetes.

Mysticetes, the baleen whales, were extremely successful in the Oligocene, Miocene and lower Pliocene, and although today represented by four families (some say three), are less successful in terms of species numbers than they were. Small *mysticetes*, called *cetotheres*, comprised at least sixty species of moderate

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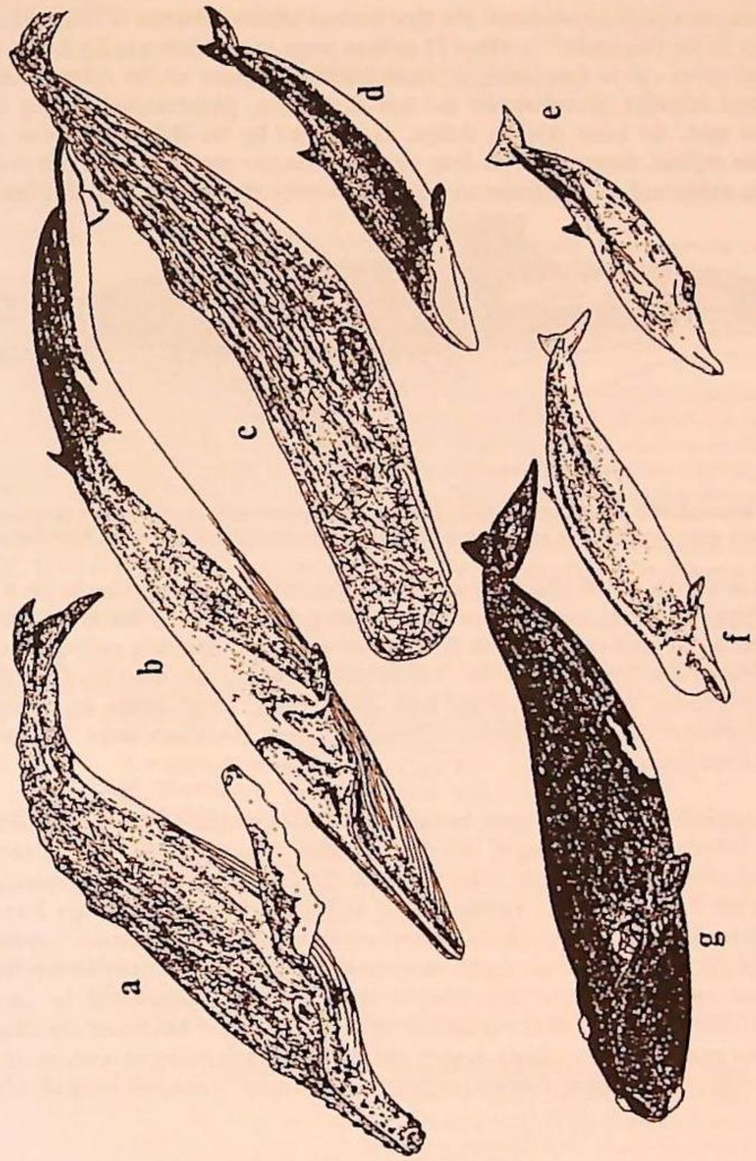

Figure. 6. Some of the variation amongst the bigger whales, representing five of their seven families; a) Humpback *(Megaptera noveangliae)* and b) Fin whale *(Balaenoptera physalus)* - representing both traditional rorqual subfamilies; c) Great sperm whale - sole living member of *physeteridae*; d) Pygmy right whale - only living *neobalaenid*; e) Skew beaked whale *(Mesoplodon hectori)* and f) Northern bottlenose whale *(Hyperoodon ampullatus)*, both of *Ziphiidae*, finally; g) Right whale *(Balaena glacialis)* represents *Balaenidae*. Common names adapted from [16].

sized whales [24] during this time of greatest success. Those that lived in the Pliocene were eaten by the 13 metre long giant shark *Carcharadon megalodon* (but that's another story!). *Mysticetes* today are mostly enormous filter feeders that sieve plankton and other small fare. To confuse matters, the unusual, and very mysterious Pygmy Right Whale *(Caperea marginata)* is only about five metres long, which is smaller than the biggest of the delphinoids we saw earlier. The Pygmy Right Whale has almost succesfully eluded science since its official recognition as a species in 1846. More about this in article six.

Pygmy right aside, baleen whales come in three definite groups. The strangely ugly Grey whale *(Eschrichtius robustus)*, once thought to be a direct descendant of the *cetotheres*, is typically regarded as occupying a family of its own. However, it may in fact be a recently evolved, very specialised rorqual (read on). The bulky, slow moving *balaenidae* or right whales - the whales hunted so extensively in the past - form the second family. They seem to have been the first group of living mysticetes to have appeared, and did so probably in the mid Oligocene [11]. Following balaenids, the group I call the Neobalaenida evolved, with the pygmy right wales appearing first. Finally, with the earliest known fossil species coming from the mid Miocene, there are the balaenopterids or rorquals, the real giants with lengths up to 31m and masses of 200 tonnes for the very biggest-the Blue Whale *(Balaenoptera musculus)*, biggest animal of all time. (Please note that some recently revealed sauropod dinosaurs may eventually win the 'largest vertebrate ever' title [25) 26)]). Rorquals are either sleek and streamlined (at least five species) or stout and bulky (the Humpback being the only member of that second group).*(See fig. 6)*. Rorquals have traditionally been segregated into two sub-families on that basis [24]. Some new genetic evidence, however suggests that the rorqual family tree is in need of revision. As the issues here are coupled with interpretation of variation amongst some of the rorqual species, this area will get fuller discussion in article five.

There isn't exactly boggling diversity amongst the giants, unlike the smaller whales but perhaps surprisingly these whales are confusing in terms of variation amongst them: EXACTLY how many species are there? Which ones are definitely species? When we are that confused about such conspicuous and well known species as the Humpback and the Blue Whale then there is definite scope for an investigation into 'hidden' forms.

Cetacean systematics.

This brings me onto what is called systematics - a subject that does not just apply to the great mysticetes but to all of the smaller whales too. Within practically all species of whale there does seem to be at least some variation between populations. In the past, practically every one of these varieties was named as a separate species, so the modern count of seventy six species is in fact a very 'slimmed down' up to datecount. Whether or not a certain variety of a certain species is different enough from others of the species to be considered a species in its own right is a very contentious subject - for that reason exactly how many species there are depends on who you ask. Article five will be on this subject - it has a bearing on cryptozoology because there may be 'new' species out there currently unrecognised, maybe thought of as part of as part of another species due to lack of significant research and the right comparisons. The confusion that this issue and the others like it cause when we begin to look at whales in detail is considerable.

Hopefully, you may get to understand this in my next article; *"The Page 254 Story"*.

References and Notes.

1. SCOTT, P. 1983. *Travel Diaries of a Naturalist* 1. Collins (London). See also my article, *"The page 254 Story"*, in the next issue of *'Animals & Men'*.
2. HEUVELMANS, B. 1986. *Annotated checklist of Animals with which Cryptozoology is* concerned. Cryptozoology 5: 1-26.
3. NAISH, D.W. Unpublished. *"Got Ya!"*. Scheduled for A&M 12.
4. LOWENSTEIN, J.M. 1985. *Marine mammal evolution: the molecular evidence*. Abstract, Proceedings of 6th Biennial Conference on the Biology of Marine Mammals. 22-26 November 1985, Vancouver. Lowenstein believes that Pakicetus, and presumably other archaeocetes too, radiated independently of other whales.
5. BERTA, A. 1994. *What is a whale?* Science 263: 180-1. Berta questions the assumption that Ambulocetus is a true cetacean, and points out that it might be a very close relative that evolved cetacean-like characteristics convergently.
6. PROTHERO, D.R., MANNING, E.M. and FISCHER, M. 1988. *The phylogeny of the ungulates*. In BENTON, M.J (ed.) *The Phylogeny and Classification of the Tetrapods, Vol. Two: Mammals*. Clarendon Press (Oxford), pp. 201-34.
7. THEWISSEN, J.G.M., HUSSAIN, S.T. and ARIF, M. 1994. *Fossil evidence for the origin of Aquatic Locomotion in Archaeocete Whales*. Science 263: 210-12.
8. KLEINENBERG, S.E. 1958. *The origin of the Cetacea*. Doklady Akad. Nauk. SSSR 122: 950-2.
9. YABLOKOV, A.V. 1964. *Covergence of parallelism in the evolution of cetaceans*. Palaeontol. Zh. 1: 97-106.
10. A similar view is maintained in (16).
11. FORDYCE, R.E. 1980. *Whale evolution and Oligocene southern ocean environments*. Palaeog., Palaeoclim., Palaeoecol. 31: 319-36.
12. MAY, J (ed.) 1990. *The Greenpeace book of Dolphins*. Random Century (London).
13. de MUIZON, C. 1993. *Walrus like feeding adaptation in a new cetacean from the Pliocine of Peru*. Nature 365: 745-8.
14. ARNASON, U. and GULLBERG, A. 1994. *Relationship of baleen whales estabished by cytochrome b gene sequence comparison*. Nature 367: 726-8.
15. NAISH, D.W. Unpublished. *"S.B.U.F.S"* - scheduled for A&M10.
16. WATSON, L. 1988. *Whales of the World*. Hutchinson (London).
17. MILINKOVITCH, M.C., ORTI, G. and MEYER, A. 1993. *Revised phylogeny of whales suggested by ribosomal DNA sequence*. Nature 361: 346-8.
18. NOVACEC, M. 1993. *Genes tell a new whale tale*. Nature 361: 298-9.
19. FORDYCE, R.E. 1992. *Evolution*. In HARRISON, R. and BRYDEN, M.M (eds.) *Whales, Dolphins and Porpoises*. Blitz (Enderby, Leicester), pp. 14-23.
20. Mammalodon is traditionally restored with throat pleats, obviously to illustrate its mysticete affinities. However, throat pleats are unique to those mysticetes which gulp in vast quantities of water, and thus need expanding throats. Mammalodon could not have fed in this way, and thus would not have needed throat pleats.
21. BARNES, L.G., DOMNING, D. and RAY, C. 1985. *Status of studies on fossil marine mammals*. *Marine Mammal Science* 1: 15-53.
22. SHUKER, K.P.N. 1986. *The Unknown*. September 1986: 49-53 and October 1986: 31-6.
23. SHUKER, K.P.N., 1993. *Gambo - the bealed beast of Bungalow Beach*. Fortean Times 67: 35-7.
24. EVANS, P.G.H. 1993. *The natural history of Whales and Dolphins*. Academic Press (London).
25. PAUL, G.S. 1994a. *Is Garden Park home to the world's largest known land animal?* Tracks in Time (Garden Park Palaeontology Society) vol. 4 No. 5.
26. PAUL, G.S. 1994b. *Big Sauropods - really, really big sauropods*. The Dinosaur Report Fall 1994: 12-13.

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